

(c) an analog to digital converter (ADC) for receiving and sampling the conditioned analog signal to produce a digital signal;

a data processor for processing the digital signal to produce desired digital data, the data processor including:

15 a transformer for selectively operating on the digital signal, performing a Fast Fourier Transform, and producing frequency spectrum data from the digital signal;

20 a digital signal processor (DSP) connected to receive and for operating on the digital signal and independently performing Fast Fourier Transforms on the digital signal to produce a frequency spectrum;
and

a central processing unit (CPU) for controlling the operation of the system including the operation of the DSP, the DSP performing the Fast Fourier Transform independently of the CPU;

25 memory interfaced with the data processor for storing at least some of the digital data;

the DSP for generating a graphical representation of the frequency spectrum, and transferring the graphical representation to the memory; and

30 a direct memory access (DMA) for transferring data directly to the memory without interrupting the CPU, the DMA transferring data including the frequency spectrum and the graphical representation from the DSP to the memory.

35 (amended). The system of Claim 32 wherein the DSP [in response to commands from the CPU] performs a true zoom operation [independently of the CPU] on the digital signal to produce a zoom digital signal representative of a selected frequency band in the digital signal.

38 (amended). [The system of Claim 31 wherein the memory further comprises:] A data collector and analyzer system comprising:
a vibration transducer for sensing vibration and for producing an analog vibration signal corresponding to the vibration;

5 a conditioning circuit for receiving and conditioning the analog vibration signal
from the vibration transducer to produce a conditioned analog signal, and
having:

- 10 (a) a filter for producing the conditioned analog signal having a desired
frequency range;
- (b) an amplifier for producing the conditioned analog signal at a desired
amplitude;
- (c) an analog to digital converter (ADC) for receiving and sampling the
conditioned analog signal to produce a digital signal;

15 a data processor for processing the digital signal to produce desired digital data, the
data processor including:

C3 a transformer for selectively operating on the digital signal, performing a
Fast Fourier Transform, and producing frequency spectrum data
from the digital signal;

20 a digital signal processor (DSP) connected to receive and for operating on
the digital signal and independently performing Fast Fourier
Transforms on the digital signal to produce a frequency spectrum;
and

25 a central processing unit (CPU) for controlling the operation of the system
including the operation of the DSP, the DSP performing the Fast
Fourier Transform independently of the CPU;

memory interfaced with the data processor for storing at least some of the digital
data;

a memory card for storing data in a card format:

30 a plug system for connecting and disconnecting the memory card to and from the
system;

a random access memory (RAM) interfaced with the data processor for storing data;
and

a RAM formatter for controlling the flow of data to and from the RAM and
configuring the RAM as a pseudo-card so that the RAM in conjunction with

the RAM formatter functions substantially identically as the memory card, receiving and transmitting data in card format.

⁶
~~39~~ (amended).

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The system of Claim [31] ~~38~~ wherein the data processor further comprises a digital filter for optionally digitally filtering the digital signal to produce a modified digital signal.

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~~40~~ (amended).

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The system of Claim [31] ~~38~~ wherein the data processor further comprises a digital filter and decimator for optionally reducing the sample rate and frequency content of the digital signal to produce a modified digital signal.

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~~41~~ (amended).

A data collector and analyzer system comprising:

a vibration transducer for sensing vibration and for producing an analog vibration signal corresponding to the vibration;

a conditioning circuit for receiving and conditioning the analog vibration signal from the vibration transducer to produce a conditioned analog signal, and having;

- (a) a filter for producing the conditioned analog signal having a desired frequency range;
- (b) an amplifier for producing the conditioned analog signal at a desired amplitude; and
- (c) an analog to digital converter (ADC) for receiving and sampling the conditioned analog signal to produce a digital signal, and having:
 - (1) a sigma-delta modulator having a number of cascaded sigma-delta loops and having a transfer function substantially of:

$$(z) = X(z) + (1-Z^{-1})^{-n}Q^n(Z)$$

where Q^n is the quantization noise from the sigma-delta modulator and n is the number of cascaded sigma-delta loops, the modulator receiving the conditioned analog signal and producing a digital modulator signal;

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- (2) a [comb filter for digitally low-pass filtering and decimating the digital modulator signal from the modulator to produce a comb signal; and
- (3) a FIR] filter for digitally low-pass filtering and decimating the comb signal to produce the digital signal for the data processor; a data processor for processing the digital signal to produce desired digital data, the data processor including:
 - a transformer for selectively operating on the digital signal, performing a Fast Fourier Transform, and producing frequency spectrum data from the digital signal; and
 - memory interfaced with the data processor for storing at least some of the digital data.

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42 (amended).

A data collector and analyzer system comprising:

- a vibration transducer for sensing vibration and for producing an analog vibration signal corresponding to the vibration;
- a conditioning circuit for receiving and conditioning the analog vibration signal from the vibration transducer, and having;
- a main conditioning circuit for receiving and conditioning the analog signal from the transducer to produce a conditioned main analog signal, and having:

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- (a) a filter having an upper cutoff frequency for producing the conditioned main analog signal having a desired frequency range;
- (b) an amplifier for producing the conditioned main analog signal at a desired amplitude;
- (c) a main analog to digital converter (ADC) for receiving and sampling the conditioned main analog signal to produce a main digital signal; and
- (d) a main microprocessor controller for controlling the main conditioning circuit; and

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an optional conditioning circuit for receiving and conditioning the analog signal
from the transducer to produce a conditioned optional analog signal, and
having:

- (a) a filter having an upper cutoff frequency for producing the conditioned optional analog signal having a desired frequency range;
- (b) an amplifier for producing the conditioned optional analog signal at a desired amplitude; and
- (c) an optional ADC for receiving and sampling the conditioned optional analog signal to produce an optional digital signal;

a data processor for processing the main and optional digital signals to produce desired digital data, the data processor including:

a main transformer for selectively operating on the main digital signal, performing a [Fast] Fourier Transform, and producing frequency spectrum data from the main digital signal; and

an optional transformer for selectively operating on the optional digital signal simultaneously with the main transformer operation, performing a Fourier Transform, and producing frequency spectrum data from the optional digital signal; and

memory interfaced with the data processor for storing at least some of the digital data.

Please add Claims 50-5⁶₈ as set forth below:

17
50. (new).

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The system of Claim 42 further comprising:

a main circuit board for mounting the main conditioning circuit and the main transformer and being electrically connected to the system;

an optional circuit board for mounting the optional conditioning circuit and the optional transformer;

plug means for selectively connecting and disconnecting the optional circuit board to and from the system.

¹⁸
51 (new).

A multichannel data collector and analyzer system capable of receiving and analyzing signals from transducers including vibration transducers comprising: multichannel conditioning circuitry for receiving and conditioning the analog vibration signals from the transducers to produce conditioned analog signals, and having:

- (a) filters for producing the conditioned analog signals having desired frequency ranges;
- (b) an amplifier for operating on an analog signal at a desired gain for producing a conditioned analog signal at a desired amplitude;
- (c) analog to digital converter means for receiving and sampling the conditioned analog signals to produce digital signals;

first and second digital signal processors (DSPs) connected to receive the digital signals for independently and simultaneously operating on the digital signals and analyzing the digital signals to produce digital data based on the digital signals, and

memory interfaced with the data processor for storing the digital data.

¹⁹
52 (new).

¹⁸
The system of Claim ~~51~~ wherein said analog to digital converter means further comprise:

a first ADC for receiving and sampling a conditioned analog signal at a relatively high sample rate to produce a first digital signal;
a second ADC for receiving and sampling a conditioned analog signal at a relatively low sample rate to produce a second digital signal; and
said data processor selectively receiving at least one of said first and second digital signals.

²⁰
53 (new).

A hand held vibration monitoring system for collecting, analyzing, and storing vibration data, comprising:
transducer means for sensing vibration and for producing at least one analog vibration signal corresponding to the vibration;

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conditioning circuit means:

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- (a) for receiving and conditioning the analog vibration signal from the vibration transducer to produce at least one conditioned analog signal;
- (b) including at least one amplifier and at least one anti-aliasing filter having an upper cutoff frequency set at a desired frequency for operating on the analog vibration signal and for producing at least one conditioned analog signal having a desired frequency content;
- (c) including a first analog to digital converter (ADC) for receiving and sampling at least one conditioned analog signal at a relatively high sample rate to produce a first digital signal; and

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- (d) a second ADC for receiving and sampling at least one conditioned analog signal at a relatively low sample rate to produce a second digital signal;

a data processor for receiving and digitally processing the first and second digital signals to produce desired digital data and for storing data based on the desired digital data;

a user input interfaced with said data processor for inputting commands and data to said data processor;

a display interfaced with said data processor for displaying information to the user; memory interfaced with the data processor for storing information including the data; and

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means for transferring information that is stored in said memory to the computer.

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54. (new)

The system of Claim 20 wherein said data processor performs a true zoom operation on at least one of the digital signals to produce a zoom digital signal representative of a related frequency band in at least one of the digital signals.

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55. (new)

The system of Claim 20 wherein said data processor performs a true zoom operation on at least one of the digital signals to produce a zoom frequency spectrum representative of a selected frequency band in at least one of the digital signals.

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